

Proposal for BPM Data Integrity Checks

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September 22, 2008

OVERVIEW

This document provides a proposed definition of status bits, methods for determining BAD and SUSPECT data, and associated ADO parameters. Software work is required at all levels – IFE DSP, ADO, BPM Manager, and BPM applications – to support the setting and use of the status information.

Many cases have existed in the past where applications have used BAD or SUSPECT BPM data. This mechanisms described herein are intended to provide proper tools to avoid improper use of BAD or SUSPECT data. The status words will be delivered to manager and application level software to ensure that BAD or SUSPECT data values are either omitted or used with caution.

THRESHOLD PARAMETERS

The following threshold ADO parameters will be provided to define levels for out-of-range data.

AcorrBcorrHighThresholdS – Acorr/Bcorr values above this threshold are near saturation and are therefore SUSPECT. Data with this condition will have the ACORR_BCORR_HIGH bit set in the status word.

AcorrBcorrLowThresholdS – Acorr/Bcorr values below this threshold but above AcorrBcorrLowLowThresholdS are below acceptable signal to noise levels and are therefore SUSPECT. Data with this condition will have the ACORR_BCORR_LOW bit set in the status word.

AcorrBcorrLowLowThresholdS – Acorr/Bcorr values below this threshold value are most likely not measuring beam, and are therefore should not be used. Typical causes for this are:

- In self trigger mode, the self-trigger did not occur as expected
- The trigger timing is incorrect
- The beam intensity is very low
- No beam exists in the selected bucket
- The gain setting should be changed from X1 to X10

Data with this condition will have the ACORR_BCORR_LOWLOW bit set in the status word.

PositionVarianceThresholdS – The position variance above this threshold indicates that the measurement is noisy and is therefore SUSPECT.

AcorrBcorrVarianceThresholdS – The variance of the sum of Acorr and Bcorr values above this threshold indicates that the measured intensity is varying during the measurement. The data are therefore SUSPECT. This may be due to RF mismatching where the beam width is changing, or longitudinal motion causing fixed-trigger measurements to be acquired around the beam peak.

COUNT OF VALID AVERAGE ORBIT MEASUREMENTS

ADO parameter: avgOrbValidCountM

This ADO parameter will be used to indicate the number of valid average orbit measurements used to calculate the average orbit value. This is the exact same functionality as the existing avgOrbStatM parameter.

Bad measurements (no trigger, Acorr/Bcorr out of tolerance, overflow/underflow, etc) will continue to be omitted from the average orbit calculation.

In continuous average orbit mode, this value will return the number of valid values in each one (or four) second period.

STATUS WORD BIT DEFINITION

ADO parameters: avgOrbStatM
 tbtOrbStatM[1024]

The following table defines bits in the Status word. The bits in the average orbit status parameter, avgOrbStatM, are the logical OR of all the samples for the given data set. That is, a set bit in the average orbit status indicates that the condition is true for one or more of the data values in the data set. Each element of the turn-by-turn status array parameter, tbtOrbStatM, provides the status for the corresponding element in the data array.

The status word from the IFE will be 16-bit values, while the status word at the ADO and Manager levels will be 32-bit values.

BIT	Name	Description	Set by:	BAD	SUSPECT
0	BAD	One or more of the BAD status bits is set	ADO		
1	SUSPECT	One or more of the SUSPECT status bits is set	ADO		
2	DIGITAL_OVERFLOW	ADC overflow bit is set	IFE	X	
3	DIGITAL_UNDERFLOW	ADC overflow bit is set	IFE	X	
4	NO_SELF_TRIGGER	(self-trigger mode only) A peak was not detected.	IFE	X	
5		Reserved for future IFE use			
6		Reserved for future IFE use			
7	ACORR_BCORR_LOWLOW	The Acorr or Bcorr data value is less than AcorrBcorrLowLowThresholdS.	ADO	X	
8	ACORR_BCORR_LOW	The Acorr or Bcorr value is less than AcorrBcorrLowThresholdS and greater than AcorrBcorrLowLowThresholdS.	ADO		X
9	ACORR_BCORR_HIGH	The Acorr or Bcorr value is greater than AcorrBcorrHighThresholdS	ADO		X
10	POS_VARIANCE_HIGH	The variance of the position values is out of tolerance	ADO	X	
11	ACORR_BCORR_VAR_HIGH	The variance of the sum of Acorr+Bcorr is out of tolerance (turn-by-turn mode only)	ADO		
12	BAD_STATUS_FROM_IFE	The value returned from the IFE for status is BAD	ADO	X	
13	BAD_TS_FROM_IFE	The value returned from the IFE for timestamp is BAD	ADO	X	
14		Reserved for future ADO use			
15		Reserved for future ADO use			
16	NO_REPORT	BPM did not report data, or timestamp does not correlate with other BPMs	Manager	X	
17	SANITY_FAILURE	The ADO has detected a communication or other problem. Ref. Sanity Failure Reason list.	Manager	X	
18	SERVICE	BPM is set to service mode	Manager	X	

Each bit is set to Logic 1 when the condition described is true.

The BAD status bit (bit 0) is set if any of the BAD bits are set, and the SUSPECT status bit (bit 1) is set when any of the SUSPECT bits are set.

A true condition for the HIGH_ACORR_BCORR bit or the OVERFLOW bit may indicate that:

- The gain setting should be changed from X10 to X1
- The beam intensity is too high for a valid measurement

The BPM ADO Sanity Failure Reasons are as follows:

```
1 "past tbt buffer end"
2 "huge tbt buffer length"
3 "past tbt buffer end"
4 "bad tbt nentries"
5 "no heartbeat"
6 "past avg buff end"
7 "bad avg buff length"
8 "past avg buff end"
9 "heartbeat memory location access failed"
10 "bad buffEnd value"
12 "undefined bpm modeReadbackM"
13 "requested mode not set"
```

1,2,3,4 6,7,8 10 12 are all basically sederta memory corruption
5 may deserve its own bit
9 means that I can't access Sederta memory at the plane's address at
all 13 also memory corruption? A bug or code version mismatch? (these
don't go to 11)

ALARMS/WARNINGS

The following additional alarms/warnings will be provided.

- Beam in machine, but no beam detected in selected BPM bucket. This will be generated by the BPM Manager and will read beam data from the Wall Current Monitor for the selected BPM bucket.

A method must be developed to notify control room operators (through the alarm system) and/or system experts when any of the BAD or SUSPECT status bits are set. The method must prevent notification when no beam is in the machine. The primary purpose of this notification is to identify troubled BPM planes, and provide a fully operational system to the extent possible.

One option to satisfy this requirement is for the BPM Manager to provide a list of BAD and SUSPECT BPM modules for each fully acquired data set. The BAD and SUSPECT lists would be generated only when at least one BPM in the full data set has valid data for more than one full turn. This logic will prevent alarms/warnings from being generated when there is no beam in the machine, when beam has not circulated more than one full turn, and when beam is not in the selected BPM bucket.